P76-10210

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
AC 202 755-8370

For Release:

IMMEDIATE

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RELEASE NO: 76-206

NASA MODIFYING SATURN-APOLLO EQUIPMENT, DISPOSING OF SOME

NASA is modifying some of the Saturn-Apollo equipment and facilities used in the Apollo, Skylab and Apollo Soyuz programs for use in future space programs and is taking steps to dispose of the remaining Saturn-Apollo hardware that has no future application.

The move marks the transition to a new phase of the space age: from an era of exploring and probing the secrets of space to a time of emphasis on exploiting near-Earth space for the benefit of this planet's inhabitants.

(NASA-News-Release-76-206) NASA MODIFYING SATURN APOLLO EQUIPMENT, DISPOSING OF SOME (National Aeronautics and Space Administration) 12 p

N77-72033

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Mailed:
December 16, 1976

The action also marks the transition of the U.S. capability to carry out manned missions in space from expendable space vehicles to that of the reusable Space Shuttle which is scheduled to undertake its first space mission within three years.

Dr. James C. Fletcher, NASA Administrator, noted: "We are fast approaching a point during the next year when the nominal Shuttle schedule would allow us to fly a Shuttle vehicle as quickly as a Saturn."

By disposing of the remaining hardware NASA will eliminate storage costs, free storage space and make facilities available for ongoing programs.

Since April 1975, NASA, at the request of Congress, has maintained its inventory of remaining Saturn-Apollo flight hardware in minimum cost storage so as to be able to restore it to flight condition if desired. Since that time the backup Skylab Workshop and the Apollo Soyuz backup docking module have been transferred to the Smithsonian Institution's National Air and Space Museum. Twenty-two H-1 rocket engines from Saturn 1B stages have been transferred for use in NASA's Thor-Delta vehicles.

NASA still has two Saturn V vehicles, flight stages from two Saturn 1B vehicles, one complete Apollo Command and Service Module and one partially assembled Command and Service Module.

The Saturn V is the rocket that launched NASA's Apollo missions to the Moon and -- in a two-stage version -- also launched the Skylab workshop into Earth's orbit. The Saturn 1B launched several unmanned Apollo missions and the manned Apollo 7, three Skylab manned missions and the Apollo portion of the Apollo Soyuz mission flown in July 1975. The Apollo Command and Service Modules are similar to the spacecraft used in the Apollo, Skylab and Apollo Soyuz mission.

Much of the Saturn-Apollo hardware is expected to be turned over to the Smithsonian Institution.

Other equipment used in the Saturn-Apollo program is being screened for possible use in the Space Shuttle or other programs.

Launch facilities at the Kennedy Space Center, Fla., and test facilities including those at the Marshall Space Flight Center, Huntsville, Ala., the National Space Technology Laboratories, Bay St. Louis, Miss., and other locations are being modified for use in the Space Shuttle program.

SATURN-APOLLO HISTORICAL SUMMARY

Initial planning for a launch vehicle having a payload capability of the Saturn 1 began in April 1957. In August 1958, studies concluded that a clustered booster of 680,400 kilograms (1.5 million pounds) thrust was feasible and the research and development effort was begun. Initial results proved that the engine clustering technique, using existing hardware, could furnish large amounts of thrust.

Rocketdyne, a division of North American Aviation (now Rockwell International) updated the Thor-Jupiter engine, increased its thrust, thus developing the 90,720-kg (200,000-lb.) thrust H-1 engine. Concurrently, from advanced studies, the 680,400-kg (1.5-million-lb.)-thrust F-1 engine was conceived and subsequently used as the power plant for the even larger boosters.

In October 1958, the Army team moved to develop a high-performance booster for advanced space missions. Tentatively called Juno V and finally designated Saturn, the booster was turned over to NASA in late 1959.

In July 1960, NASA first proposed publicly a post-Mercury program for manned flight and designated it Project Apollo. The Apollo goals envisioned at the time were Earth-orbital and circumlunar flights of a three-man spacecraft.

During 1960, Douglas Aircraft Co., Inc. (now McDonnell Douglas) was selected to build the Saturn 1 second stage (S-IV) and Rocketdyne was chosen to develop the hydrogen fueled J-2 engine for future upper stages of the Saturn vehicles.

On May 25, 1961, President John F. Kennedy proposed to Congress that the United States accelerate its space program, establishing as a national goal a manned lunar landing and return by the end of this decade. In his report to Congress President Kennedy said:

"Now is the time... for this nation to take a clearly leading role in space achievement, which in many ways may hold the key to our future on Earth."

With endorsement by Congress, the national objective of manned lunar exploration created an immediate need for a considerably more powerful booster -- later designated the Saturn V.

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Following another six-month study, NASA announced in January 1962 that the Saturn V, using a cluster of five F-1 engines, would generate 3.4 kg (7.5 million lb.) of thrust, thus providing the liftoff power for the lunar landing program. After announcing that NASA would undertake the task of developing the Saturn V, contracts were awarded to Boeing Co. and North American to build the first two stages of the Saturn V.

The second stage has a cluster of five J-2 engines developing a combined thrust of 450,000 kg (one million lb.). The third stage (S-IVB) and instrument unit were already under development for the smaller Saturn by Douglas and IBM, respectively.

Later in 1962, NASA announced it was developing the Saturn IB which combined the first stage of the Saturn I and the top stage of the Saturn V for Earth orbital tests of the Apollo spacecraft.

On Aug. 9, 1961, Massachusetts Institute of Technology was selected to develop the Apollo spacecraft guidance and navigation system. Three and a half months later, NASA selected North American Aviation for the Apollo spacecraft command and service module program.

In mid-July 1962, NASA selected the lunar orbital rendezvous mode for the lunar mission. This called for development of a two-man lunar module to be used for landing on the Moon and returning to lunar orbit. Grumman Aircraft Engineering Corp. was selected to design and build the lunar module on Nov. 7, 1962.

One year later, the first Apollo command module was flown at White Sands Missile Range in a launch pad abort test. The first high altitude abort was successfully demonstrated on May 13, 1964. Fifteen days later a Saturn I placed the first Apollo command module into orbit from Cape Kennedy.

The first full systems Apollo command module was launched aboard a Saturn IB, and successfully tested the module's reentry heat shield. The Feb. 26, 1966, test was also the first flight of a Saturn IB.

The first phase of the Saturn launch vehicle program was completed in 1965. In 10 flights of the Saturn I, 10 were successful -- an unprecedented record in rocket development. Much technology was proven in the Saturn I program. The rocket guidance system was developed. The concept of clustered rocket engines was validated and the program supplied experience in using liquid hydrogen as rocket fuel. Liquid hydrogen provides double the fuel economy of earlier fuels.

The Saturn IB launch vehicle was successfully flown three times in three attempts in 1966. Two of these flights carried spacecraft to space where they satisfactorily completed requirements for Apollo command and service modules in Earth orbital operations.

On Jan. 27, 1967, tragedy struck the nation's space effort when a fire erupted inside an Apollo spacecraft during ground testing at Cape Kennedy, resulting in the deaths of Astronauts Virgil Grissom, Edward White II and Roger Chaffee. After two and a half months of investigation, involving 1,500 people, the Board of Inquiry determined that the most likely cause of the fire was electrical arcing from certain spacecraft wiring. After an extensive investigation by an Accident Review Board, NASA followed with detailed descriptions of corrective actions, schedule modifications, and cost estimates necessary to move the program toward its objective.

On Nov. 9, 1967, the first flight test of the Apollo-Saturn V space vehicle was successfully accomplished. Designated Apollo 4, the unmanned flight demonstrated performance of the previously unflown first and second Saturn V stages, the restart-in-orbit capability of its third stage, the Apollo spacecraft ability to reenter Earth's atmosphere at lunar mission return speeds, performance of the integrated space vehicle, and the operational readiness of Kennedy Space Center Launch Complex 39. All mission objectives were met following an on-time launching and an eight-hour, 37-minute mission. The Saturn V placed a total weight into orbit of over 126,415 kg (278,699 lb.) after a near perfect countdown. The spacecraft heat shield performed satisfactorily during the 39,910-kilometer-per-hour (24,800-mile-per-hour) plunge into Earth's atmosphere.

During the Jan. 22-23, 1968 Apollo 5 mission, lunar module systems and structural performance met all objectives, including two firings of both the ascent and descent propulsion systems.

The unmanned Lunar Module I was boosted into Earth orbit by a Saturn IB. Post-flight analysis determined the lunar module ready for manned Earth orbital missions.

The April 4, 1968 flight of Apollo 6 was the second unmanned Saturn V mission to demonstrate launch vehicle and spacecraft systems performance. Two problems were experienced with the rocket systems -- vertical oscillations or "POGO" effect in the first stage and rupture of small propellant lines in the upper stages -- in an otherwise successful mission.

The precise reentry and splashdown on Oct. 22, 1968, of the 11-day Apollo 7 flight ended what was called a 101 per cent successful mission. Manned by Astronauts Walter Schirra, Donn Eisele and Walt Cunningham, the Apollo 7 performed flawlessly for more than 780 hours in space including eight firings of the spacecraft's primary propulsion system and the first live TV from a manned vehicle.

Apollo 8 lifted off precisely on time, Dec. 21, 1968, from the Kennedy Space Center for history's first flight from Earth to another body in the solar system. Apollo 8 performed flawlessly for 147 hours and over a half million miles of space flight which included 10 revolutions around the Moon, lunar and Earth photography and live television broadcasts.

Apollo 9 splashed down in the Atlantic Ocean, northeast of Puerto Rico, at 12:00:53 EST, March 13, 1969, after a 10-day, 9.65-million-km (6-million-mi.) Earth orbital mission. All major mission objectives were met in the first five days of flight. Apollo 9 was the first all-up manned flight of the Apollo-Saturn V space vehicle, first manned flight of the lunar module, first Apollo EVA and included rendezvous and docking, live television, photographic surveys of Earth and observations of Pegasus II satellite and Jupiter. This was the fourth Saturn V on-time launch (11:00 a.m. EST).

Apollo 10 successfully completed man's second lunar orbital flight, passing within 14.5 km (9 mi.) of the lunar surface in a dress rehearsal for the actual lunar landing mission. Lifting off at 12:49 p.m., May 18, Apollo 10 spent nearly 62 hours (31 revolutions) in lunar orbit, sent 19 live color TV transmissions and splashed down within 6,400 meters (7,000 yards) of its primary recovery ship in the Pacific Ocean eight days and three hours after launching.

Apollo 11 attained the national goal, set by President Kennedy in 1961, of landing men on the Moon and returning them safely to Earth within the decade of the 1960s. The mission was launched precisely on time from Kennedy Space Center at 9:32 a.m. EDT, July 16, 1969, by a Saturn V. The LM touched down in the Moon's Sea of Tranquility at 4:18 p.m., July 20, and Commander Neil Armstrong stepped onto the lunar surface at 10:56 that evening followed by LM pilot Edwin E. Aldrin, Jr. Their activities were viewed live around the world by the largest television audience in history. The returning spacecraft splashed down in the Pacific Ocean, southwest of Hawaii, at 12:51 p.m. EDT, July 24 after a flight of 8 days, 3 hours, 19 minutes. Scientific instruments were left on the Moon and samples of the Moon's soil and rocks were brought back, along with still and motion pictures.

Exactly four months after the Apollo 11 landing, the Apollo 12 repeated this achievement, landing and exploring at the Ocean of Storms, opening a new era in manned scientific exploration. The Nov. 14-launched Apollo 12 mission demonstrated the point landing capability, and implaced the first Apollo Lunar Surface Experiments Package on the surface for continued science reporting. Two EVA periods were completed by the astronauts, which included experiments emplacement, field geology investigation and Surveyor III inspection. The crew for the 10-day, 4.5-hour mission was Commander, Captain Charles Conrad, Jr.; Command Module Pilot, Captain Richard F. Gordon, Jr.; and Lunar Module Pilot, Captain Alan L. Bean.

Apollo 13 was launched April 11, 1970, to land on the Fra Mauro upland area of the Moon where the crew would retrieve surface samples and emplace geophysical instruments during two EVA periods. A rupture of the service module oxygen tank at 10:11 p.m. EST, April 13 caused a power failure of the command and service electrical system which prevented the lunar landing. The crew used the lunar module as the command post and living quarters for the remainder of the flight. The lunar module descent engine provided propulsion to make corrections in the flight path which sent the spacecraft around the Moon on a free return trajectory for reentry and splashdown in the Pacific Ocean 142 hours, 54 minutes, 41 seconds after liftoff.

The Apollo 13 review board announced on June 30 that a short circuit ignited electrical insulation in the spacecraft oxygen tank No. 2, causing failure of the tank. The board recommended the command and service module system be modified to eliminate potential combustion hazards in high-pressure oxygen of the type revealed by the accident.

The spacecraft was modified in accordance with the board's recommendations for Apollo 14 to be launched no earlier than Jan. 31, 1971, to land on the Fra Mauro area of the Moon.

Apollo 14 accomplished the third manned lunar surface exploration mission. The spacecraft was launched at 4:03 p.m., Sunday, Jan. 31, 1971, and the lunar module touched down on the Moon at 4:17 a.m. EST Feb. 5 within 60 feet of the targeted point on the Fra Mauro formation. Landing coordinates were 3 degrees, 40 minutes, 27 seconds South latitude; 17 degrees, 27 minutes, 58 seconds West longitude. Mission Commander Alan B. Shepard, Jr., and Lunar Module Pilot Edgar D. Mitchell successfully carried out two periods of extravehicular activity on the lunar surface; the first of 4 hours, 50 minutes and the second for 4 hours, 35 minutes, totalling 9 hours, 25 minutes. They successfully deployed and activated the Apollo Lunar Surface Experiments Package, an array of geophysical instruments which are transmitting data on the Moon's interior and exterior environment to Earth. In addition, they collected 96 pounds of lunar rocks and soil, which included two rocks weighing about 10 pounds each, the largest obtained to date. After spending 33 1/2 hours on the Moon, the lunar module lifted off the surface at 1:47 p.m. Saturday, Feb. 6, 1971. The earthbound portion of the mission was normal and the spacecraft splashed down in the south Pacific Ocean at 4:05 p.m. EST Feb. 9, 1971.

The fourth lunar landing mission, Apollo 15, was launched Monday, July 26, 1971, at 9:34 a.m. EDT. Modifications to the spacecraft permitted longer lunar surface stay time and additional scientific instruments in lunar orbit. The 12-day, 7-hour, 12-minute mission was commanded by Astronaut David R. Scott, with Command Module Pilot Alfred M. Worden, and Lunar Module Pilot James B. Irwin.

On July 30, 1971, at 6:16 p.m. EDT, Scott and Irwin landed at the Hadley Apennine site, 26 degrees, 6 minutes North latitude and 3 degrees, 39 minutes East longitude. During their 66-hour, 55-minute stay on the Moon they explored the lunar surface for a total of 18 hours, 36 minutes, retrieved approximately 170 pounds of surface samples, deployed geophysical instruments and described geological features. Command Module Pilot Worden conducted extensive scientific experiments while orbiting the Moon which included the operation of two cameras and gamma ray and X-ray sensors mounted in the service module. After 74 lunar revolutions and ejection of a subsatellite, the spacecraft began its earthbound journey. Astronaut Worden egressed from the command module and retrieved the camera film during the transearth coast. The Pacific Ocean landing was Aug. 7, 1971, at 4:46 p.m. EDT.

Apollo 16, the fifth lunar landing mission, was launched April 16, 1972, at 12:54 p.m. EST. The 11-day, one-hour, 51-minute mission was commanded by Astronaut John W. Young with Thomas K. Mattingly II as command module pilot and Charles M. Duke, Jr., as lunar module pilot. The spacecraft splashed down in the Pacific April 27. The lunar explorers returned approximately 210 pounds of Moon rocks and soil samples to Earth from the Descartes highlands. In lunar orbit Mattingly operated a complex array of scientific instruments, two lunar mapping cameras and observed geological features on the surface. A scientific subsatellite was placed in lunar orbit before the transearth maneuver was performed. On the earthbound trip Mattingly egressed from the spacecraft for one hour, 24 minutes to retrieve the film canisters from the lunar cameras.

The final Apollo mission, Apollo 17, was launched Dec. 7, 1972. On the 12-day mission, Astronauts Eugene A. Cernan, mission commander, and Dr. Harrison H. Schmitt, lunar module pilot, explored the Taurus-Littrow landing site, emplaced geophysical instruments and collected 243 pounds of samples. Total surface EVA time: 22 hours, 4 minutes. Ronald E. Evans, command module pilot, operated scientific instruments and cameras in lunar orbit and and retrieved the camera film during a 1-hour, 6-minute inflight EVA enroute back to Earth. Splashdown in the Pacific occurred Dec. 19.

SKYLAB

There were four launches in the Skylab Program, all from the Kennedy Space Center. First launch on May 14, 1973, by a two-stage Saturn V, placed the 100-ton Skylab space station in a 270-mile Earth orbit. The first crew to visit Skylab was launched May 25. Crew members were Navy Capt. Charles Conrad, Navy Commander Paul Weitz and Navy Commander (Dr.) Joseph Kerwin. Duration of the mission was 28 days and 49 minutes. The second crew was launched July 28; mission duration was 59 days, 11 hours and 9 minutes. Crew members were Navy Capt. Alan Bean, Marine Major Jack Lousma and civilian Dr. Owen Garriott. The third crew was launched Nov. 16; mission duration was 84 days, 1 hour and 16 minutes. Crew members were Marine Lt. Col. Gerald Carr, Air Force Lt. Col. William Pogue and civilian Dr. Edward Gibson. Saturn IBs were used to launch the crews in modified Apollo spacecraft.

When the third and final manned Skylab mission splashed down in the Pacific Feb. 8, 1974, the three crews had traveled 70.5 million miles over the 171 days, 13 hours and 14 minutes they had spent orbiting the Earth. They had circled Earth 2,476 times, during which they spent over 3,000 hours conducting eight categories of experiments. EVA time totalled 41 hours, 46 minutes. Data returned included 175,047 frames of solar observation film and 46,146 frames of Earth observation film. Approximately 238,600 feet of magnetic tape of Earth observations were also returned. A highlight of the third mission was extensive observation and photography of Comet Kohoutek. This mission of over 84 days increased the previous record length in space set by the second Skylab crew by about 50 per cent.

APOLLO SOYUZ TEST PROJECT

The final mission using Saturn-Apollo hardware was the Apollo Soyuz Test Project in July 1975. The Apollo spacecraft with a docking module was launched from the Kennedy Space Center on a Saturn IB rocket seven and a half hours after the launch of a Soyuz spacecraft by the Soviet Union at the Baikonur Cosmodrome near Tyuratam in the Kazakh Soviet Socialist Republic.

The Apollo, piloted by Astronauts Thomas P. Stafford, Vance D. Brand and Donald K. Slayton, docked with the Soyuz, piloted by Cosmonauts Alexey A. Leonov and Valeriy N. Kubasov, July 17 above the Atlantic Ocean east of Portugal. The docked spacecraft and their crews carried out two days of joint operation before they separated and the Soyuz landed in the Soviet Union July 19. The Apollo continued in orbit for five additional days and landed in the Pacific Ocean west of Honolulu July 24, nine days, eight hours and 18 minutes after the Soyuz launch. The mission was the first joint manned space flight involving spacecraft from two nations. Twenty-eight scientific and technical experiments were carried out by the Apollo crew including five joint experiments with the Soyuz crew.